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LIBBEY-OWENS-FORD COMPLETES BIG OTTAWA PLANT

By FRANK BARDROF

With the completion of its program for new construction and equipment at a cost of over $1,600,000, the Libbey-Owens-Ford Glass Co., is now operating a completely integrated plant for the production of automobile safety glass at Ottawa, Illinois. All glass formerly produced by Libbey-Owens-Ford at Ottawa was melted in pots and made by the Bicheroux method of casting, but the new plant additions incorporate most up-to-date facilities for batch storage and preparation and for continuous melting, rolling and annealing of plate glass. Until the new plant was started a few weeks ago, no glass had been produced at Ottawa for several years, the laminating plant being supplied with glass from the L-O-F glass plant at Charleston, West Virginia.

The big plant is located on a 200-acre, fenced-in plot which lies at the western outskirts of Ottawa along the bank of the Illinois river. There is an air of spaciousness—the buildings are not crowded together—and the general appearance of the place is enhanced by the well-kept lawns, drives and buildings. Ottawa has long been famous for its deposits of fine silica sand, and plate glass has been produced on this site for many years. The National Plate Glass Co. operated the plant before it was taken over by Libbey-Owens-Ford.

The structures housing the production units now include the batch storage house, producer house, tank building, lehr building, rough glass transfer building and the grinding and polishing building. All of these are new with the exception of the grinding and polishing building and part of the transfer building. The entire unit is in the form of a letter U, with its base to the North; the east section housing the tank, rolling machine and lehr. The transfer building forms the base of the U and the west section houses the grinding and polishing lines. The producer house is adjacent to the East side of the tank building. The batch storage house is located South of the end of the tank building, to which it is connected by an enclosed gallery at the second-floor level.

The new section of the transfer building is 480 ft. long by 140 ft. wide and the new lehr building is 55 ft. wide by 480 ft. long. A cullet storage house, 70 ft. by 140 ft., is located in the inside angle between the lehr and transfer buildings. The furnace building is 125 ft. wide by 260 ft. long. Fig. 1 is a general view of the new structures from the Northeast and Fig. 3 shows a corner of the tank building from the opposite direction. All of these buildings are constructed of brick with structural steel framework.

For some years Libbey-Owens-Ford has used plate glass continuous grinding and polishing machinery developed by Pilkington Bros., Ltd., of St. Helens, England, and an agreement was consummated with the English firm for the use of its tank, forming machine and lehr before the extension at Ottawa was begun. Ground was broken in May, 1937, the general contract having

Fig. 1. New construction at the Ottawa plant of the Libbey-Owens-Ford Glass Co., viewed from the Northeast. From left to right can be seen the producer house, a corner of the batch house, elevated water tank, new stack, melting tank building, lehr building and the rough glass storage building with its train shed, at the extreme right.

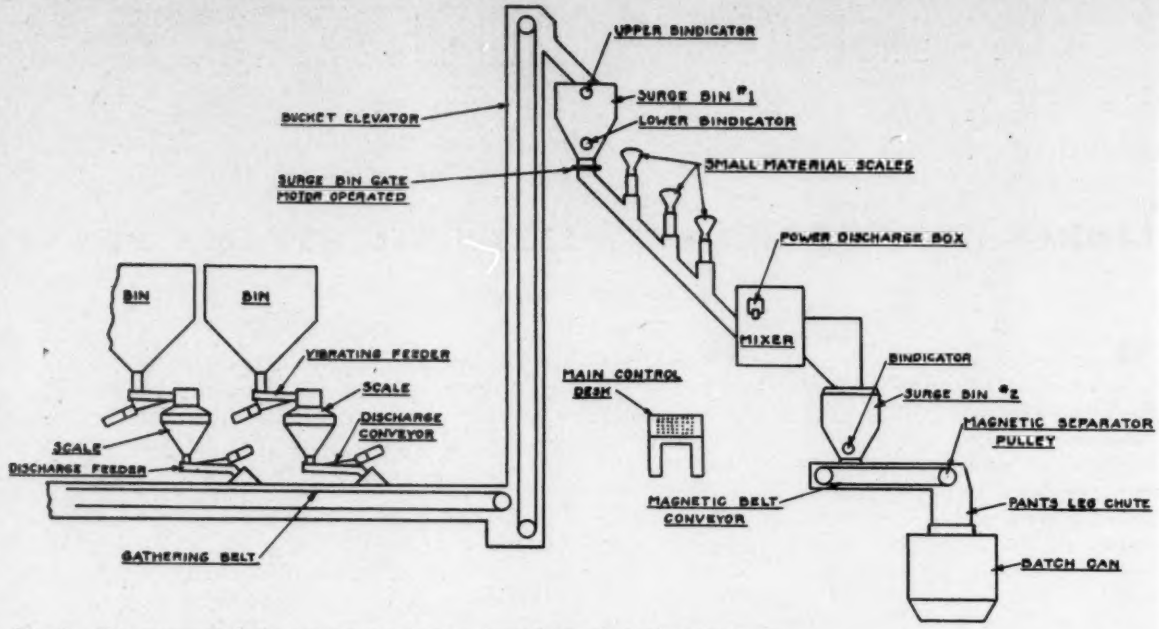


Fig. 2. Diagrammatic layout of batch weighing, handling and mixing equipment.

been given to the A. Bentley & Sons Co. of Toledo. All of the general plans and layouts for buildings and equipment were made by the Libbey-Owens-Ford engineering department.

Besides the buildings already mentioned and the batch and producer houses, which will be taken up in more detail later, the new construction also included a 20 ft. x 480 ft. train shed for unloading carload materials, a 213-ft. brick chimney, a water-softening house and pumping plant with a water-cooling tower and a 500,000 gallon storage basin, a 500,000 gallon elevated water tank, and an 80 ft. x 140 ft. storeroom for miscellaneous stores.

Batch Storage

The new monolithic concrete storage house for batch materials is illustrated in Fig. 4. It was built by the Nicholson Company and incorporates six circular bins or silos, each 44 ft. high and 30½ ft. in diameter. A longitudinal gallery about 15 ft. high runs beneath the bins to house the weighing and gathering equipment and another gallery at the top of the structure is provided for the traveling conveyor that discharges into the bins. Railroad sidings are located close to the building at each side and each siding has a track hopper with a suitable shelter. The hopper nearest the end of the building can be used only for the unloading of sand. The other track hopper handles all other bulk materials and can be used for sand also in an emergency. Pan feeders lead from the hoppers to the elevators which carry the materials to the top of the house. Hoppers, conveyors and elevators for the unloading system were furnished by the Link-Belt Co., as was also the traveling conveyor above the bins.

Sand will normally be received at the plant in covered gondolas, bottom dump, discharging directly from car to track hopper. Other materials can likewise be handled from similar type cars. To take care of unloading from box cars, in the event material is shipped in that manner, a power shovel is provided at the sand hopper and both power shovel and airveyor at the other hopper, both shovel and airveyor delivering material from car to track hopper. Power shovel furnished by Link-Belt Co. and airveyor by Fuller Kinyon.

Each bin has a capacity of about 1,000 tons, the first one (Fig. 4) being used for sand and the second and third for lime and limestone. Soda ash is stored in the fourth bin and in one-half of the fifth, the latter being divided by a vertical partition. The other half of the fifth silo holds feldspar and the sixth salt cake. The floor of the salt cake bin is at a higher level than the others, leaving a space in which is located a salt-cake crusher and feeder furnished by Jeffrey. A seventh and smaller bin for powdered coal is located at the end of the line within the structure which houses the handling and mixing equipment, this structure being connected to the tank building by an enclosed gallery.

Batch Preparation

The operation cycle for weighing, gathering and mixing is entirely automatic and under the control of one man at the central control desk, all equipment being interlocked electrically so that the functions are performed in proper order. The mixed batch is delivered to batch buckets or cans at the end of the gallery leading to the tank, each can holding one mixer load of about 4,600 pounds. Cullet is not mixed with the batch but is handled separately, as will be explained later.

The batch preparation equipment is shown diagrammatically in Fig. 2. Materials flow from the bins through Jeffrey bin gates to Jeffrey vibrating feeders which discharge into scale hoppers. The hoppers are mounted on a lever system that actuates Toledo scales, the latter being arranged to control very accurately the amount of material delivered to the hoppers by the feeders. The weighed amount of each constituent is delivered to the

gathering belt by another vibrating feeder, this function being intermittent and controlled by interlocks from other points. The gathering belt runs continuously and discharges into a continuously running elevator which, in turn, delivers the unmixed batch into surge bin No. 1 at the top of the building. The gathering belt and the batch elevator were furnished by the Chain-Belt Co. Figs. 5, 6, 7 and 8 are views of the weighing, feeding and gathering equipment, and the top of the elevator boot with the surge bin.

Surge bin No. 1 has a motor-operated gate and is also furnished with Bindicators at full and empty levels, the latter serving as electrical controls for other sections of the system. Limit switches on the gate serve a like purpose. When the gate is opened the batch is delivered through a slanting chute to the Chain-Belt mixer and, during the passage, three small Toledo Scale feeders deliver small amounts of cobalt oxide, rouge and arsenic into the passing material. At the end of the mixing time the power discharge box of the mixer discharges the mixed batch into surge bin No. 2 which is also fitted with a Bindicator near the bottom. Fig. 9 shows the three small feeders and in Fig. 10 can be seen the bottom of No. 2 surge bin with the Bindicator.

Below surge bin No. 2 is a rotating feeder which discharges upon a short conveyor provided with a magnetic pulley. This conveyor finally discharges the batch through a "pants-leg" chute into the empty batch can on the tramrail, a limit switch on the chute being so arranged that the feeder and conveyor cannot operate unless the chute is in "down" position against the can openings. Fig. 11 shows the central control desk with a can at the loading position and the pants-leg chute, in the upper left corner, in contact with the top of the can.

Automatic Interlocking Features

The automatic and interlocking features which permit control of the entire system by one man at the central control desk are quite complicated but very ingenious and interesting. It is apparent that there are three points at which the mixer load of batch can be collected and held: the weigh hoppers, the upper surge bin No. 1, and the lower surge bin No. 2. The system is, therefore, divided into three sections, the first of which weighs and gathers the batch constituents and delivers them into No. 1 surge bin. The second section loads the mixer, mixes the batch and delivers it to No. 2 surge bin. The third section carries the batch into the batch can on the tramrail. For purposes of discussion it can be assumed that each stopping point is loaded with batch and the action of the system can then be followed in detail.

When the weigh hoppers are being filled with their predetermined loads of materials an interlock in the discharge feeders prohibits discharge of any one until all are filled. With all hoppers filled the action of the discharge feeders starts automatically when the gate in No. 1 surge bin is closed and the lower Bindicator shows empty. As the material leaves the weigh hopper

Fig. 3. Closer view of the tank building and stack from the Southwest. Note housing for the long belt conveyor which transports cullet from the cullet house at the left.

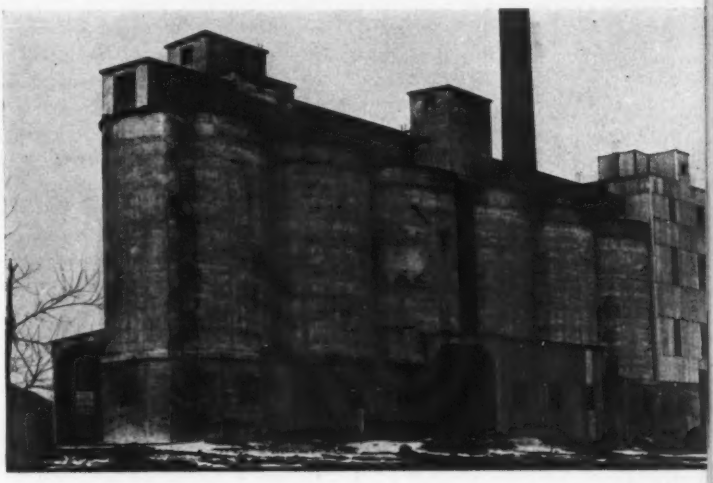


Fig. 4. New batch house. The space below the silos houses the weighing apparatus, handling and mixing equipment being located in the structure at the far end.

Fig. 5. Looking down the weigh gallery beneath the silos. The gathering belt housing is located on the floor and the elevator rises at the far end. The weigh hoppers shown handle soda ash, feldspar and salt cake, respectively.

the scale pointer returns to zero, automatically stopping the discharge feeders. The upper feeders, see Fig. 6, then start automatically and, as the material enters the hopper, the scale pointer moves to indicate the weight in the hopper at any instant. When the pointer nears the predetermined weight the feeder slows down automatically and the final amount is dribbled slowly into the hopper. The pointer continues slowly to the exact weight and at this point the feeder is instantly and automatically stopped. This cycle leaves all weigh hoppers filled and ready for another discharge as soon as the No. 1 surge bin is again empty and ready to receive another load of batch.

As soon as No. 2 surge bin has emptied its load the rotating feeder and the conveyor to the pants-leg chute both stop and the motor-operated gate in No. 1 surge bin automatically opens to discharge the load of batch into the chute to the mixer, the three small scale feeders delivering their prescribed amounts of material into the chute as the more bulky materials pass on the way to the mixer. As soon as No. 1 surge bin is empty the gate again closes and another charge is delivered to the bin from the weigh hoppers. The mixer runs continuously but at the end of a predetermined mixing cycle (approximately six minutes), discharges the mixed batch to No. 2 surge bin.

The starting of the discharge from No. 2 surge bin is controlled by the position of the pants-leg chute. The operator causes an empty batch can to be centered under the chute and the chute to be lowered into contact with the openings in the top of the can, as shown in Fig. 11. With the chute lowered a touch on the "cycling" button on the desk starts the rotary feeder and the magnetic conveyor shown in Fig. 10, and the contents of the No. 2 surge bin are delivered into the batch can on the tramrail. All of the other functions of the system then follow automatically in the manner described above, preparing another load of batch for the next empty can on the tramrail. The system is designed to deliver a load of accurately weighed and thoroughly mixed batch every 6½ minutes. All functions can also be manually controlled from the desk.

There are a total of nine automatic Toledo scales in the system with capacities ranging from a fraction of an ounce to 5,000 lb. The three small scales for cobalt, arsenic and rouge have photoelectric control and will weigh a fraction of an ounce of material with great accuracy and deliver it to the batch chute. Engineers of the Toledo Scale Co. and the Chain-Belt Co., working with the L-O-F engineering staff, designed the automatic control and interlock system and the central control desk. It will be noted that the batch has no opportunity to get into contact with the delicate parts of the weighing mechanisms and that the entire system is fully enclosed for the elimination of dusty conditions in and about the batch house. The magnetic pulley conveyor, rotary feeder, both surge bins and the mixer were furnished by the Chain-Belt Co.

Fig. 6. Vibrating feeder for loading weigh hopper above and discharge feeder below. Hopper suspended on lever system which connects to scale in background.

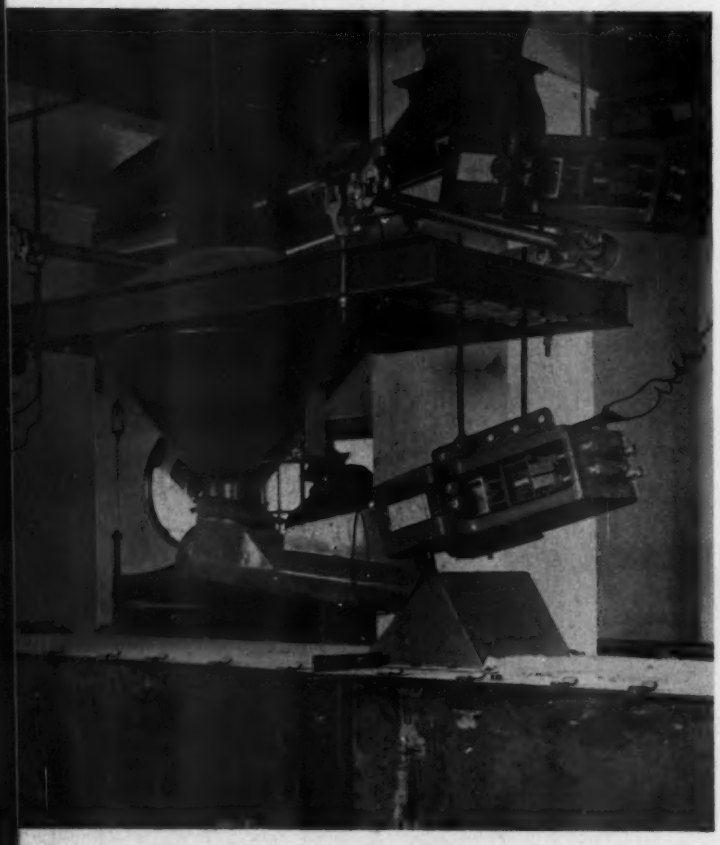
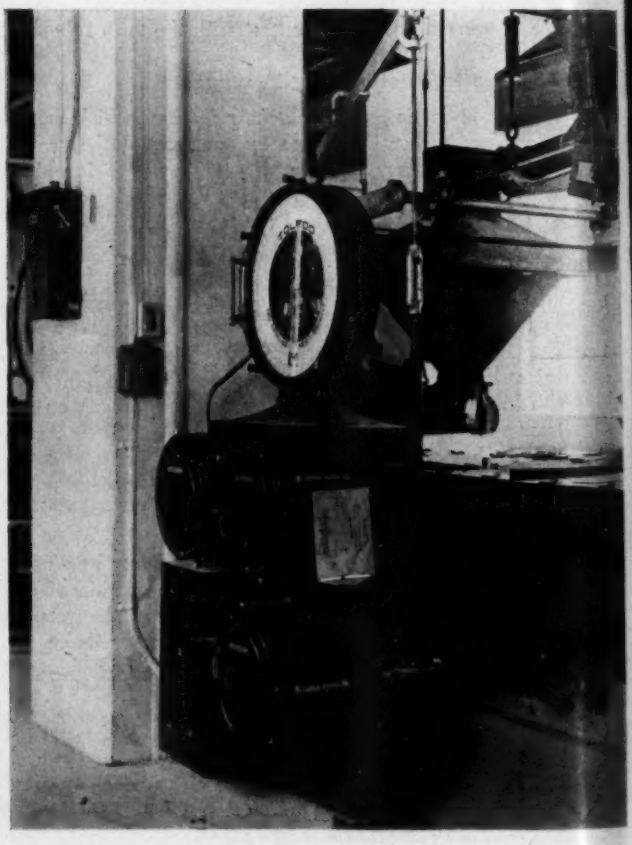


Fig. 7. Typical Toledo scale application showing lever connection to weigh hopper in background. Electric control located in cabinet beneath scale dial.



The big steel cans filled with mixed batch are transported to the tank feeder positions on a tramrail system furnished by Cleveland Tramrail Division of the Cleveland Crane & Engineering Co. Six batch cans and their carriers are connected together to form a train and each train is pulled by an electric tractor. At present seven six-car trains are in use, thus providing sufficient storage capacity so that the batch house does not have to operate continuously to provide batch for continuous tank feeding. From the loading position the tramrail makes a small loop around the control desk and passes down one side of the gallery toward the tank. Then it makes a big loop around the back of the tank room, passing above a mezzanine floor and over the two feeder positions at the rear of the tank, and returns to the filling position through the gallery. A siding is provided in the gallery into which a train may be switched for repairs. Fig. 12 is a view looking down the gallery toward the tank and Fig. 13 shows a train at the first tank feeder position. At the top of Fig. 14 a train can also be seen at the second tank feeder position.

The tramrail system is divided into thirteen sections or "blocks." Three of the blocks are controlled manually by push buttons, by means of which the train may be moved forward or backward as desired. These blocks are located at the filling position and at each of the two tank feeder positions, so that the operator at each of these points can center a can accurately under the filling chute or over either of the discharge openings at the tank. The other blocks are automatically controlled by limit switches so that a train cannot pass into any block until the preceding train has left it. There are five automatic blocks between the filling position block and the first tank feeder block. Five automatic blocks are also provided on the return line between the second tank feeder block and the filling position.

The electric tractors have four wheels running on the upper side of the tramrail flange and two driving wheels spring-pressed against the bottom face of the flange. The driving wheels are geared to an electric motor which gets its current from two trolley wires secured at the sides of the rail. The tractors pull the loaded trains at a speed of 25 ft. per minute and each tractor is able to move two loaded trains if necessary.

The method of loading the batch cans has already been explained. When the whole train is loaded the operator at the central control desk causes the train to move forward into the first automatic block and its further movement toward the tank is entirely automatic thereafter. If there is no loaded train ahead of it, it will proceed clear to the first tank feeder position where it will be under the control of the operator at that point. On the other hand, if there is a train ahead the loaded train will stop in the block behind and then follow automatically as the leading train moves forward block by block. The same kind of automatic operation occurs when the empty trains are on the return trip from the tank.

Fig. 8. View in top of mixing house showing top of elevator boot and No. 1 surge bin. Limit switches actuated by motor-operated bin gate may be noted.

Fig. 9. Three small Toledo Scale feeders with photoelectric control which deliver cobalt oxide, arsenic and rouge into the descending batch.

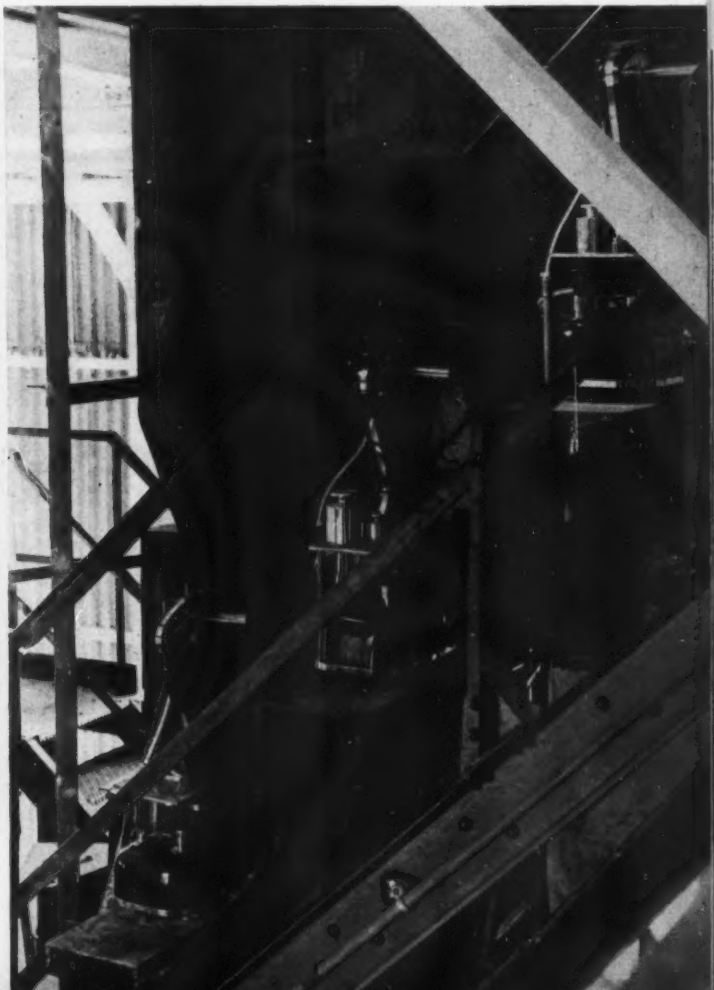


Fig. 10. From No. 2 surge bin (upper right) the mixed batch is discharged through the rotary feeder to the magnetic conveyor belt and delivered to the "pants-leg" chute.

Fig. 11. Central control desk with a train of batch cans at the loading position on the tramrail in the background. Note the "pants-leg" chute in the upper left corner.

At each of the tank feeder positions the operator centers a batch can over the square opening of a hopper. A rubber seal is raised against the bottom edge of the can and the gate in the can bottom cannot be opened until the seal is in position. From the hopper the batch flows to the tank feeding mechanism shown in Fig. 14, but before following its progress further it is well to consider the cullet system, since the cullet is handled entirely separate from the batch until the tank feeders are reached.

Cullet Handling System

From the capping table at the end of the lehr the cullet falls into two hoppers from which it is discharged through heavy 4-inch mesh grids onto pan feeders that transport it to a point under the floor of the cullet building previously mentioned. At this point the cullet falls on the belt of a conveyor which is 670 ft. long and conveys the material to the cullet bin above and to the rear of the tank. Both the long conveyor, the housing for which may be seen in Figs. 1 and 3, and the pan conveyors are products of the Link Belt Co. Cullet from other sources than the capping table is stored on the floor of the cullet building and is delivered by a crane bucket to the cullet conveyor through heavy grids in the cullet building floor.

From the bin in the top of the tank building the cullet flows downward through two slanting, hopper-type chutes which can be seen in Figs. 13 and 14. A Jeffrey vibrating feeder takes the cullet at the lower end of each chute and delivers it to the tank feeding mechanism.

Tank Feeders

The tank feeding mechanism is so designed that the cullet and the other batch ingredients can be fed separately, following the English practice of depositing the batch on a raft of cullet, or the cullet and batch can be fed simultaneously. As shown in Fig. 14, the cullet and batch are carried by vibrating feeders from their respective hoppers and deposited in a third vibrating feeder parallel to the axis of the tank. This feeder, in turn, deposits the materials in a fourth feeder, the latter being water cooled and carrying the charge into the tank. The water-cooled feeder is mounted on the framework of a movable truck so that it can be easily and quickly withdrawn from the furnace. It will be apparent that the feeding mechanism is very flexible and permits the feeding of batch and cullet in almost any desired proportion.

Melting Tank

The new melting tank is 128 ft. long and 28 ft. wide, inside, and was built by Toledo Engineering Co. It follows the Pilkington design and incorporates special Pilkington features. An unusual feature of the construction is an adjustable shade wall developed by L-O-F engineers and located between the melting and refining

Fig. 12. Looking down the gallery to the tank. Left, an empty can train returns to the loading position. The small Cleveland Tramrail electric tractor pulls the train.

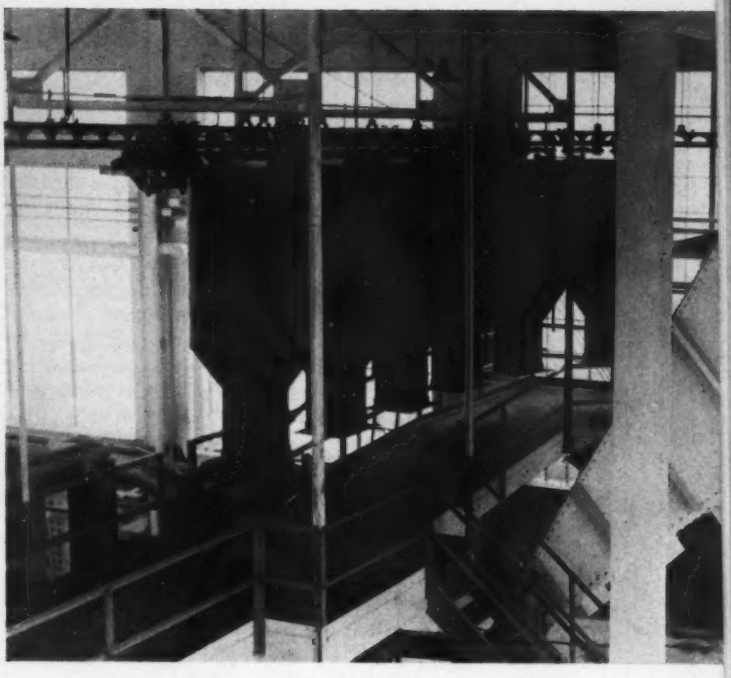


Fig. 13. A train of loaded batch cans at the first tank feeder position, with the chute leading from the cullet bin to the tank feeder shown at the right.

ends of the tank. This wall can be lowered to within one inch of the glass surface, if desired, and was furnished by the Dietrich Arch Co. The metal line in the tank is four feet above the bottom, the total weight of glass in the tank being about 1,200 tons.

Tank refractories were furnished by several manufacturers, including North American Refractories Co., Chas. Taylor Sons Co., Corhart Refractories Co., Ohio Valley Clay Co., General Refractories Co., and the Chicago Retort & Fire Brick Co. A partial air-cooling system was furnished by Kirk & Blum.

A very interesting and unusual accessory in the tank operating mechanism is an automatic apparatus for reversal. A Cutler-Hammer program controller is set in motion by a time clock and causes the following sequence of events:

1. A General Electric thruster is actuated and closes the valve in the steam line to the producers.
2. The motor-operated, water-cooled Blaw-Knox valve in the producer gas line closes.
3. Valves in waste gas flues from the producer-gas checkers reverse.
4. Valves in waste gas flues from air checkers and combustion air valves reverse.
5. G-E thruster is actuated and opens steam line to the producers.
6. Gas line valve (opposite valve mentioned in No. 2) opens.

At present the furnace reverses automatically every twenty minutes without attention or supervision. Tem-

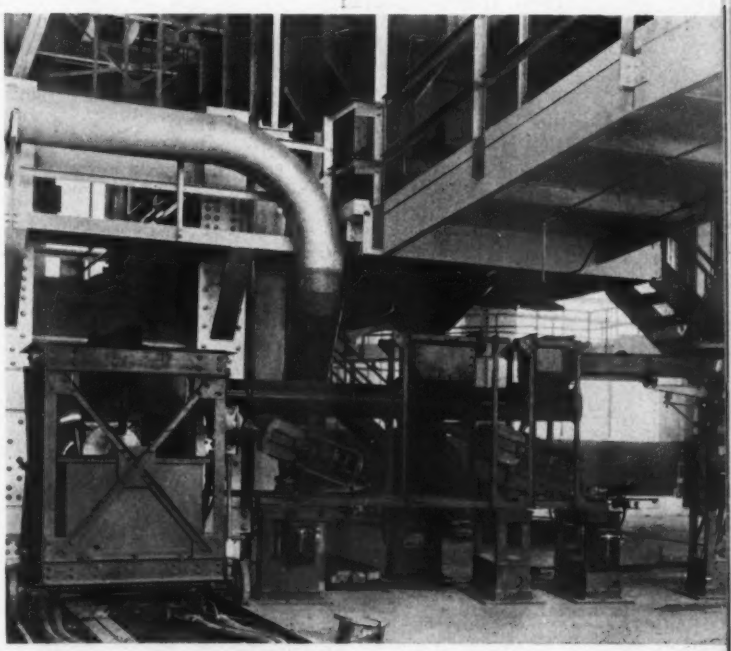


Fig. 14. One of the two sets of tank feeding mechanism. Vibrating feeders discharge cullet and batch into the large horizontal feeder in the center. This discharges into a water-cooled feeder, mounted in the truck at the left, for delivery to the tank. A train of batch cans may be seen at the top.

perature indicating equipment was supplied by Leeds & Northrup.

Producer Gas Plant

The new producer gas plant is located close to the east wall of the tank building and is shown in Fig. 15. Coal bins are located in the top of the producer house, the coal being delivered to the bins from a track hopper by a bucket elevator. Cars are spotted over the hopper by a Stephens-Adamson car puller. Three Morgan 10-ft. gas producers are installed and discharge gas through cyclone-type dust arresters into a horizontal header, the end of which can be clearly seen in Fig. 15. From this header two gas lines lead into the tank building, only one of the lines being used at a time. All gas lines are heavily insulated to reduce heat losses and prevent the formation of tarry by-products. These mains are lined with 4½ inches of Super-X brick and 4½ inches of fire-clay. Ashes are automatically dumped into small cars which, in turn, deposit the ashes in a concrete-lined pit at the side of the building. The pit is emptied by a locomotive crane.

At present two of the producers are operated and the other is held in reserve. Each burns 5,000 lb. of coal per hour. The gas pressure is controlled by an Askania regulator through a Mason-Nielan regulating valve on the steam line. Gas pressures are indicated by a Hayes draft gauge and recorded on a continuous chart. The general scheme of the producer plant, together with the tank firing apparatus was developed by the engineering department of Libbey-Owens-Ford, and the detailed design was produced by Forster, Wernert & Taylor.

New Water System

Water for the Ottawa plant is now supplied by a 1,200-ft. well which has a natural flow of 455 g.p.m. Due to the hardness of available water a softening plant was found necessary and this is located along side the pumping plant on the river bank. A set of low-pressure pumps forces the hot water coming back from the plant to a cooling tower, from which it flows into a 500,000-gallon concrete storage basin. Makeup water from the softener plant is also pumped at low pressure into the

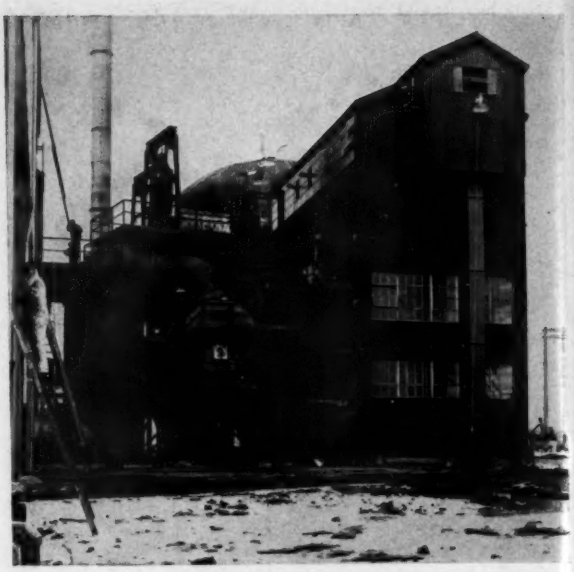


Fig. 15. New producer house adjacent to tank building.

basin. High-pressure pumps draw from the basin and deliver at high pressure to the plant. A new 500,000-gallon elevated tank, built by the Graver Tank & Supply Co., floats on the line. An overflow from the elevated tank leads back into the storage basin. The softening apparatus was designed by Hoover & Montgomery and the cooling tower by the Marley Company. Fig. 16 shows the new water tank with the melting tank, lehr and tranfer buildings in the background.

When working under a full production schedule the Libbey-Owens-Ford plant at Ottowa employs about 1,800 people in all departments. A. S. Middleton is general manager at Ottawa and I. G. Fowler, who was transferred from the engineering department at Rossford about a year ago, is assistant to Mr. Middleton. Albert Guthrie is superintendent of maintenance for the big plant and R. L. Shute is tank superintendent.

D. H. Goodwillie, executive vice president of Libbey-Owens-Ford, is largely responsible for the conception and development of the expansion program at Ottawa and has been very closely associated with the conduct of the enterprise since its inception. All features of the new plant were planned and laid out in the L-O-F engineering department at Rossford under the supervision of J. L. Drake, chief engineer. With the completion of the new plant Libbey-Owens-Ford starts it first completely integrated unit for the production of laminated safety glass by the continuous process and consolidates its position as one of the leading manufacturers of this type of product. The new tank will produce about 330,000 sq. ft. of ¼-in. plate per week and it is interesting to note that every part of the new constructon has been designed for further expansion when necessary.

Fig. 16. The new 500,000 gallon water tank, with the melting tank, lehr and transfer buildings in the background.

40 YEARS OF THE AMERICAN CERAMIC SOCIETY

Forty years ago, a group of about twenty men assembled at Orton Hall, on the Ohio State University Campus. They met in answer to the call of Professor Edward Orton, Jr., who, in anticipation of the meeting, had arranged a technical program on ceramics. Thus in the summer of 1898 was founded the American Ceramic Society, and the papers read at that meeting constitute Volume I of the Transactions of the American Ceramic Society.

For the next twenty years, half of its present life, Professor Orton served as secretary and editor of the Society. And he did so without compensation of any kind. During all of this period, the Society was strictly an academic institution. Between meetings there was no committee activity. Summer sessions, however, were attempted even then; but these proved to be strictly social affairs, excursions to different points of interest. The number attending was limited, and there is some question whether they justified the amount of effort expended in their organization.

In the course of time, the publication work grew in volume and in importance, and during the last years of Professor Orton's tenure of office, he received help from a succession of editors; in 1911, from Ross C. Purdy, and then successively Homer F. Staley, W. D. Richardson, and Arthur S. Watts. Several attempts were made to secure abstracts of the ceramic literature; but it remained for the administration of Dr. E. W. Washburn to set up the pattern that is still being followed in *Ceramic Abstracts*. As Dr. Washburn's term as editor lasted but a few months, he did not have time to secure the world-wide coverage which *Ceramic Abstracts* since has achieved.

Another signal accomplishment of this period was the appointment of a Committee on Geological Survey. This committee formulated recommendations to state and federal surveys, and also sponsored a bill, which it wrote, creating the Bureau of Mines, with Ceramics as one of its divisions. Thus, while the Bureau of Standards at a later date established a Ceramics Division, the beginning of ceramic research in the federal bureaus was really initiated by and at the instigation of the American Ceramic Society, in 1906.

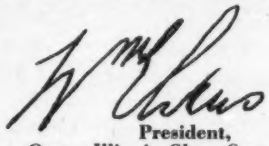
Shortly after, the Society sponsored the translation and publication of Seger's works, and compiled a booklet on ceramic calculations. It began promoting ceramic research and education in several colleges, and activated the State Geological Surveys to search for and investigate ceramic raw materials.

By 1910 it became evident that the several ceramic industrial units, both individual manufacturing concerns and organized associations, were becoming intensely interested in technical research. The Society had on its roster a few who were interested in glass and a few who were interested in enamels. The industrialists were just beginning to realize the importance of employing technically-trained men and of giving support to a technical society devoted exclusively to ceramics. Although widely divergent in character of product, it was evident to many that the basic science, and much of the technology, of ceramic ware production was of interest to each and all.

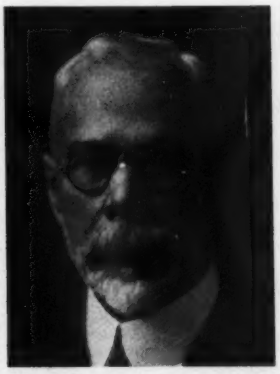
In spite of this, the one-program type of meeting did not attract the attendance and participation of people other than those interested in clay ware, and even the technical men from our schools and laboratories were loath to read papers on glass and enamels to audiences made up practically of persons not interested in the subject being presented. It was thought best to reorganize the Society into divisions, each division with its own officers and committees, and each with its own meeting program. (*Continued on page* 136.)

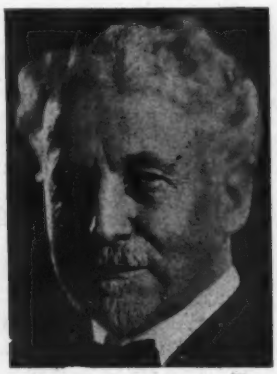
CONGRATULATIONS!

The Fortieth Annual Meeting of the American Ceramic Society being held this month recalls the great contribution it has made in the past through encouraging the utilization of ceramic technology in industry. The progress of this society, particularly in recent years, is an indication of the even greater influence which it can exert in aiding the ceramic industries to make a more important place for themselves in the business of the future.



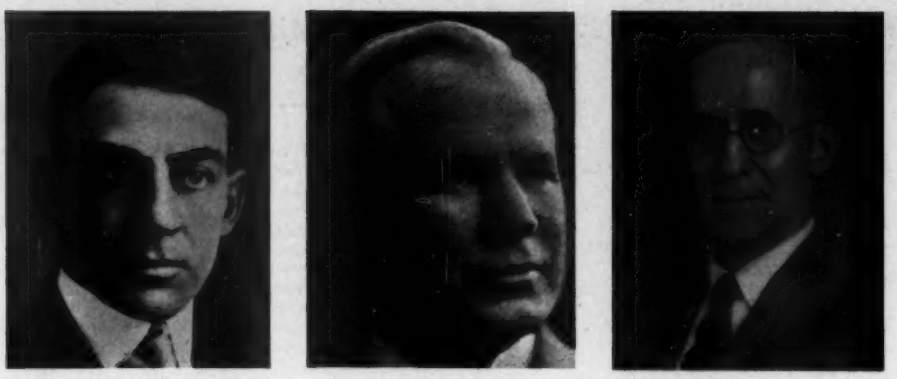
President,
Owens-Illinois Glass Co.





SECRETARIES AND EDITORS OF THE SOCIETY

For the first 20 years, founder Edward Orton, Jr., was both secretary and editor. Under his successors, the positions were separate: Charles F. Binns becoming secretary and E. W. Washburn editor. From 1922 until the present, Ross C. Purdy has been the first and only full time secretary-editor.



Editors Homer F. Staley, W. D. Richardson and Arthur S. Watts.

In 1918 this was done; the Society reorganized into Divisions and established standing committees. But the fear and expectation was quite general that the federation would not survive longer than it would take the Divisions to become sufficiently strong to go off by themselves. As it turned out, these Divisions were the means of the Society's gaining strength. Today, it has eight strong Divisions. The strength of the Division has been the strength of the Society, and the strength of the Society in turn has been the strength of the Division.

The reorganization plans called for the employment of both a secretary and an editor. The first new secretary was Charles F. Binns, a man of great abilities who served the Society for the next four years. Dr. E. W. Washburn was editor. He made several very valuable contributions editorially to the Society during his few months' tenure of office, notably the establishment of *Ceramic Abstracts* already mentioned.

Although the Society was still wholly academic in its concepts and activities, its scope had broadened widely. Consequently, it soon became evident that its executive head would have to be an individual who could give his entire time to the project and who could make the Society his first, last and only interest. Heretofore, all of its editors and secretaries had been men with other interests, engaged in collegiate teaching, able to give only a part—if a major part—of their time to the Society's work. A full-time secretary and editor, however, did not seem practical, since the Society had neither funds in its treasury nor an annual income sufficient for such an undertaking. However, there were members who were able to envisage the future of the Society upon a more virile and aggressive basis, and who had the courage to take the step, in spite of the financial handicaps. As a result in 1922, Ross C. Purdy was employed as the first full-time secretary and editor.

This step was taken shortly after the first issue of *Ceramic Abstracts* had appeared. The abstracts consisted largely of reprints from the publications of other societies and journals. Sixteen years have intervened since then. Today, as for some time past, the Society employs its own abstractors and thus has control over and assurance of its literature and its coverage. This latter quite thoroughly blankets the world with respect to literature of interest to ceramists, and one result has been that other societies, scientific, technical, at home and abroad, reprint with credit a considerable amount of the Society's abstracts.

One of the new secretary's ideas was to have a publication to be known as the *Bulletin*. The Society considered that proposal with great hesitancy, and to demonstrate his idea, Mr. Purdy actually published and distributed the first issue at his own expense. The *Bulletin* has been a tool for promoting ceramics and the affairs of the Society.

Five years ago the Society decided to issue its publications in a larger format, thus making easier the reading of the papers published and obtaining considerable economy in publishing. This larger format had been under consideration for eleven years, always with disapproval on the part of the Publications Committee and the Board of Trustees until 1933. This larger format has proven to be very acceptable and effective.

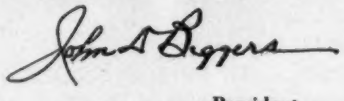
During the past sixteen years the Society has not only had Divisions and several standing committees which are very active, but it has promoted technical research by trade associations independent of the Society and many local clubs in apparent competition and duplication of meetings of its Local Sections.

CONGRATULATIONS!

The manufacture of glass started in this country in a small way. The road was not easy and many failures resulted, but perseverance won and the number of factories increased steadily. Technical information was either lacking or hard to secure. Contacts between glass men were few and far between. In the American Ceramic Society, however, an organization came into being which aided in the exchange of information, and published the results of extensive investigations which are invaluable to the glass technologist. Standard methods of testing glass and ceramic materials are being developed and improved; chemical analyses have become more reliable; educational facilities for glass technologists are improving; these, and many more advances, I believe, can be attributed directly or indirectly to the influence of the American Ceramic Society.

Research, such as encouraged by the American Ceramic Society, has been an important factor in the progress made by the Libbey-Owens-Ford Glass Company; in fact, the Company was formed as the result of the successful completion of a major research problem—the production of sheet glass drawn in the form of a continuous ribbon from a tank furnace.

The Libbey-Owens-Ford Glass Company has continued to hold research in high esteem and as evidence of our faith in research, a new Technical Building will be completed within the next few weeks. This building, equipped with modern facilities for conducting research, will house the Chemical, Physical and Engineering Divisions of the Company; and problems pertaining to plastics, glass, refractories, and their production will be studied.



President,
Libbey-Owens-Ford Glass Co.

All of the nine Local Sections have been kept active and productive, and they have been a wonderful help to those local clubs and state associations.

During the past twenty years the Society has collaborated with other organizations interested in ceramic products. The American Ceramic Society has activated and given support to every agency, association, and publication which would, in any way, contribute to the general purposes for which the Society was organized; i.e., promotion of ceramic arts, science and technology.

The American Ceramic Society holds Meetings and publishes its three monthly journals (*Journal, Ceramic Abstracts,* and *The Bulletin*) merely as a means for accomplishing the purposes for which it was organized. The Society is not primarily interested in the issuance of publications. It does not engage in any enterprise whatsoever for profit. It has proceeded on the policy of paying as it goes, and it goes as it can pay. It has no competitor; hence it can afford to promote and assist every agency which is working toward the same common end. This may be an uncommon philosophy and may appear to be wholly unselfish, but it is wholly selfish in its intent and very productive in its results.

One or two illustrations suffice: After the American Ceramic Society had formulated the Structural Clay Products Research Institute and had organized a very effective program of university collaboration on reinforced masonry, and after it had published seven bulletins (the first to appear in this country on the subject), the Common Brick Manufacturers Association, without consulting the Society, organized a reinforced brick institute or committee and adopted the same scheme and program of research at universities as had been formulated by the Society's Structural Clay Products Institute. When the Society learned of this movement on the part of the Common Brick Manufacturers Association, it offered that Association every support and collaboration, and offered to merge programs without participation in its management. The Society, in this instance, was not interested in anything other than the promulgation of factual information as to the merit of reinforced brick masonry. It felt that the Common Brick Manufacturers Association, with its $25,000.00 subscription, could push this investigation more rapidly and to more satisfactory conclusion than could the Society, which was financially unable to undertake the task.

The Society, without reservation and with completeness, has invested its interest in standards of materials and products in the American Society for Testing Materials. In the case of several trade associations, while the Society's own committees have collaborated actively with them, the results of this committee work are reported solely to the trade associations and are published solely by them.

In all of these collaborations and cooperative activities the Society gains largely and sacrifices nothing because, through the activities of these several agencies outside of the Society, its basic objectives are being carried on. This, after all, is the big reason for its existence.

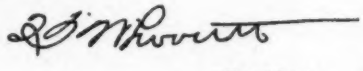
It is through the pursuit of such broad-minded policies, which eschew personal gain or profit, but which make for the promotion of the ceramic industry's best interests throughout the United States, that the American Ceramic Society may look forward to another forty years of even greater accomplishment and prosperity and contribution to the development of science.

CONGRATULATIONS!

The Pittsburgh Plate Glass Co. wishes to felicitate the American Ceramic Society on its fortieth anniversary. Starting modestly as most worthwhile projects do, it has grown soundly to a mature institution of solid value. The fact that its growth and success depends entirely upon the unselfish cooperation of its members speaks impressively of its membership.

Our company has recognized the value of research in glass and refractories, as evidenced by our research activities of the past four decades. This has been further emphasized by our recent expansion of those activities. One of the prime reasons for our past and present interest in research is our determination to provide the consumer market with the best products available in our field. Coupled with this is our equal determination of developing new products that will further enhance the well-being of humanity. The prosecution of these aims is definite evidence of a recognition of our obligations to mankind.

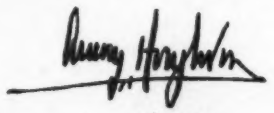
Individuals of our organization have given freely of their energies in service to the American Ceramic Society, and we feel that this contribution has been of mutual value. It is with sincerity that we hope the next half century will mark as much progress in the activities of the American Ceramic Society as the last forty years have shown.



President.
Pittsburgh Plate Glass Co.

CONGRATULATIONS!

Corning Glass Works sends heartiest congratulations to the American Ceramic Society on the occasion of its fortieth anniversary. The Society provides a worth while forum for the discussion of technical problems related to ceramic industries and Corning Glass Works wishes for it many years of continued activity and usefulness.



President,
Corning Glass Works.

GROUND BROKEN FOR NEW BUILDING

The School of Mineral Industries will benefit considerably by the $5,000,000 building program under way at the Pennsylvania State College under the auspices of the General State Authority. The addition to the present Mineral Industries building will consist of a rear central wing to complete the building as originally planned. The wing will consist of a main central section, 37 by 75 feet, four stories high. Added to this will be right and left wings, each 35 by 67 feet, one story high. The exterior walls of the unit will be brick, trimmed with limestone, to correspond with the architectural design of the present building.

The addition to the Mineral Industries building, ground for which was broken Feb. 28, will provide urgently needed laboratory space for undergraduate instruction in metallurgy, ceramics, petroleum and natural gas engineering, fuel technology, geography, geophysics, etc. It will also provide facilities for certain laboratory instruction and research which are not available in the present building.

M.I.T. GLASS MEETING THIS SUMMER

The Department of Metallurgy of the Massachusetts Institute of Technology, Cambridge, Mass., has announced a special summer program on ceramics which will be devoted: 1. to the nature of glass and 2. to the reactions in ceramic materials on heating. The meetings, which will take two weeks (July 11-23), are divided into two sections, as indicated above.

The section on the nature of glass will be opened Monday, July 11, by F. H. Norton of M.I.T., who will present an introduction to the course. That same morning, B. E. Warren, also of M.I.T., will talk on "The Nature of Glass as Interpreted by X-Ray Studies." On Tuesday morning, July 12, Professor Warren will present the second part of his study. On Wednesday morning, Dr. W. Weyl of the Kaiser Wilhelm Institute will speak on "The Nature of Glass as Interpreted by Light Absorption." Thursday morning, H. R. Lillie, Corning Glass Works, will discuss "The Nature of Glass as Interpreted by Viscous Properties." And Friday morning, July 15, H. H. Blau of Corning will speak on "The Nature of Glass as Interpreted by Devitrification." And finally on Saturday morning, G. W. Morey of the Carnegie Institute will summarize "The Nature of Glass." Each lecture will be followed by an open discussion and the afternoons will be devoted to laboratory experiments based on expansion, viscosity, color, devitrification, and an x-ray powder pattern.

The second week, beginning Monday, July 18, will be concerned with the reactions in ceramic materials on heating. Professor Norton, who will introduce the course that morning, will be followed by G. B. Wilkes of M.I.T., who will speak on "The Measurement and Control of Temperature." Tuesday morning, there will be a lecture by Dr. Morey on "Equilibrium Diagrams and Their Interpretation." Wednesday morning, H. Insley, National Bureau of Standards, will treat "The Effect of Heat on Clay." On Thursday morning. July 21, F. P. Hall, Onondaga Pottery Co., will cover "The Reactions Occurring in a Whiteware Body on Heating and Cooling." Friday morning, R. B. Sosman of the U. S. Steel Corporation will treat "The Reactions Occurring in Refractories on Heating and Cooling." Professor Norton will start the final sessions Saturday morning, discussing "The Reactions Between Glazes and Bodies on Heating and Cooling." Discussions will follow each lecture and the afternoon sessions will be devoted to laboratory experiments. In this division they will cover 1. the standardization of pyrometers; 2. thermal analysis of clays; 3. weight loss of clays on heating; 4. measurement of glaze stresses; 5. effect of heat treatment on glaze.

Tuition fee for each course will be $30, and since only a limited number can be accommodated, applications should be sent in at an early date to F. H. Norton, Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass.

NEW PHOTOGRAPHIC LENS

A new photographic lens, called the Metrogon, which enables a single photograph taken straight down from an airplane to show three times as much area as has previously been possible from the same altitude, has been developed by engineers of the Bausch & Lomb Optical Co.

URBANA CONFERENCE ON GLASS PROBLEMS

The Department of Ceramic Engineering of the University of Illinois, Urbana, Ill., has announced that plans are being made for the Fifth Annual Conference on glass problems, to be held May 20-21. The purpose of these conferences is to provide a forum for all who may be interested in glass plant problems. The present conference has been called in response to requests received from numerous persons who attended the previous sessions.

THE FLUORESCENCE OF GLASS

Due to an error one line was omitted from the article, "The Fluorescence of Glass" by P. Gilard, L. Dubrul, F. Jamar and D. Crespin, which appeared on page 99 of the March issue of THE GLASS INDUSTRY. On page 99, second column, fourth paragraph down, is given the composition of two batches. The word "calcium" should be "calcium carbonate." The first "hydrate" should be "aluminum hydrate" and the second "hydrate" should be "potassium hydrate." This article was translated from the December issue of *Verres et Silicates Industriels*.

FEBRUARY WINDOW GLASS PRODUCTION

Window glass production during the month of February, 1938, was 537,025 boxes which represents 33.1 per cent of the industry capacity. As compared with this, February, 1937, production was 808,814 boxes, which represented 49.7 per cent of the industry capacity.

• D. K. Addie, B. Sc., A. M. E. I. C., who has been with the Dominion Glass Co., Ltd., Montreal, for the past 13 years, is now supervising engineer of Ball Brothers Co., with headquarters in Muncie, Ind.

• Edmond Charles Frappier, 70, founder of the National Glass Co., Montreal, died Sunday, Feb. 6, at his home in Outremont, Que.

• Glass mannequins are now being used in Paris for displaying men's clothes. At Fournier's, near the Madeleine, the mannequins are of glass with faces modeled in cubistic design and frosted over to diffuse the light which illuminates them from inside. The mannequins revolve slowly around the show case.

• Word comes from Vienna that Mario Petrucci, one of the foremost Viennese sculptors, is at work on a very striking monument to Shakespeare. It is to be of glass and is taking the form of one of Shakespeare's greatest characters, Hamlet, with a skull at his feet and standing on a pillar on which the word "Shakespeare" is inscribed.

NEW FIXTURE ASSOCIATION ORGANIZED

The National Lighting Fixture Guild was recently organized at a meeting of fixture dealers and jobbers in the Pennsylvania Hotel, New York. The objectives of the Guild include public education on the indispensability of adequate outlets to assure efficient lighting. The cooperation of the various allied industries is solicited by the Guild whose headquarters are at 630 Fifth Ave., New York.

WHAT'S DOING AT NEW ORLEANS

Probably no city on the North American continent can compete with New Orleans for genuine "color." Members of the American Ceramic Society not only will have the privilege of listening to important technical papers at their annual meeting but will also be able to visit a section of their country redolent of the flavor of early America, its mixed population and its points of historical interest.

Actually New Orleans consists of eight cities built on eight peaks in the dismal waste of the Metairie Swamp; but through the years engineers have succeeded in making it one of the most sanitary of America's great cities. Dreamed of in 1718 by Bienville and laid out two years later by the Frenchman, Le Blond de la Tour, New Orleans was the site where the domination of Spain, and then France, in the New World ended—where criminals were nailed alive in their coffins and sawed in two. A trip through the Vieux Carré in the Old City brings to life again the days when Creole beauties strolled its quaint street and echoes the names and deeds of Bienville, the explorer; Almonester, the philanthropist; Lafayette and Jackson, the soldiers; Lafitte, the pirate; Patti, Lind and Bernhardt, the singers; Edeson and Sothern, the actors; Cable and Twain, the writers; to mention only a few of the immortals whose names will forever be associated with America's most unique city.

Some of New Orleans' historical and modern flavor will be imparted in the entertainment to be presented on Sunday night, March 27, by 37 students from the nearby universities. They will start at the very beginning, when La Salle claimed the "heart of America" for King Louis XIV of France and down through such important events as the Louisiana Purchase, the gay Nineties, the birth of jazz, with a grand finale, "The Big Apple." Most of these students have appeared previously in various floor shows in and around New Orleans so that it is safe to predict that their performance will far surpass any mere "amateur night." Entertaining as this gay panorama will be, it cannot hope to do full justice to America's most Parisian city.

New Orleans cooking alone is enough to whet the appetite of the most jaded epicure. Best known, perhaps, of its many famed dishes is Oysters a la Rockefeller which is a specialty of the restaurant La Louisiane. Incidentally, a banquet is planned there for the ceramists on Tuesday evening. There are as well a variety of game fowl, chickens, grand wines and even the coffee, stepped up with chicory, has a flavor in New Orleans that it has no place else. Speaking of coffee, a visit to the coffee stand in the old French Market is an experience of a lifetime. Here one literally rubs elbows with everyone from the Colonel's lady to Judy O'Grady.

But there's more to New Orleans than food; the very atmosphere, with the old and the new side by side, lends an enchantment to be found no place else on the American continent, except perhaps in Canadian Quebec. In the Vieux Carré are to be found all sorts of historic treasures. The Cabildo, for example, where the Louisiana Territory was transferred from Spain to France to the United States; the St. Louis cathedral; the Pontalba Buildings, America's first apartment house; Chalmette, where the Battle of New Orleans was fought during the War of 1812; not to mention the picturesque plantation homes and the spacious pre-Civil War homes located in the Garden District.

For salt-water swimming and boating there's Lake Pontchartrain, where Little Eva, immortalized in "Uncle Tom's Cabin," used to spend her summers. A visit to Lake Pontchartain is an experience not to be missed.

Various tours in and around the city have been arranged and offer a real opportunity to enjoy one of the most interesting cities in the world. For it is not only a historic city of culture and gaiety, but an important seaport, as well as an industrial and agricultural center of the Southland. Whatever may be remembered from the technical papers to be read at the Glass Division meetings, the trip to this city of beauty, culture and industry will long remain a bright spot in the memories of those who are fortunate enough to be able to visit New Orleans.

In nearby Pass Christian are the Middlegate Japanese gardens, famed for their delicate beauty, lakes, islands and bridges, luxuriant shrubs and flowers, all authentically Japanese.

In bygone days, New Orleans buried its dead above-ground. These tombs, many of them a hundred feet long and three or four tiers high, are one of the curiosities no visitor to New Orleans should miss.

ENTRANCE STAIR AND FACADE OF THE SAINT-GOBAIN EXHIBIT

The steps are made of Securit (tempered) glass, each of them being 2 m. wide by 22 mm. thick, and weighing 50 kg. Being flexible, they yield slightly to the tread. Thermal shock tests to simulate the effect of cold rain following a day of hot weather, and strength tests, gave an ample safety factor. Securit glass steps were chosen in preference to sand blasted slabs, the latter being considered at first because of their non-skid qualities.

The Facade consists of seven tiers of bent plate glass, each pane measuring 3.65 x 3 meters, with a peripheral curve to an 11 meter radius. Over the doorway is the Saint-Gobain monogram, in silvered and chipped glass mosaic and silver-ribbed glass.

GLASS AT THE PARIS EXPOSITION

At New Orleans, this month, the attention of the ceramic industries will be directed to the New York World's Fair when a proposal will be made that the American Ceramic Society should sponsor a joint exhibit of ceramic products. Such a cooperative enterprise would have no connection with the independent exhibit already projected by Libbey-Owens-Ford nor with the joint exhibit of Corning, Pittsburgh Plate and Owens. A representative of the Fair will go to New Orleans to address one of the general meetings.

On the other side of the continent, at San Francisco, a rival Golden Gate International Exposition will also feature glass, with three of the same manufacturers exhibiting. Libbey-Owens-Ford and Pittsburgh Plate Glass will be housed in the Palace of Homes and Gardens. Owens-Illinois has taken a large block of space. Kerr Glass Company will promote glass jars for home canning, and demonstrate their use.

As it is quite within the realm of possibility that American ceramic products may have to stand comparison with competitive exhibits of foreign mnaufacturers, the accompanying views of the Saint-Gobain pavilion at the Paris Exposition have general interest. This building and its appointments furnish a remarkable illustration of the use of glass of all types in modern architecture.

Some of its most interesting features are briefly touched upon in the accompanying captions. For this information we are indebted to *Glaces et Verres;* for the pictures themselves to the distinguished house of Saint-Gobain and to the celebrated French photographers, Schall and Laval.

HUGE BOWL OF OPTICAL GLASS

This fountain is an immense bowl of "bent optical glass," parabolical in shape and measuring 2.5 m. in diameter x 35 mm. in thickness. It weighs 440 kilos. The bowl is all ready to be polished and put to use as a reflector. The pavilion is surrounded by a number of beautifully landscaped spots, such as this one, with pools of water, fountains, and expanses of lovely fresh-green grass. These offer charming contrasts to the geometric severity of the exposition hall.

THE PAVILION PROPER

The interior of the exposition hall is rendered deceptively large by the use of huge 15 m. square mirrors, covering the rear walls. This room is built from a single tier of hollow glass brick, each one 30 cm. square and 10 cm. thick. Seven thousand five hundred "Verisolith" blocks were used in the walls alone.

Floors and ceilings are of "translucent concrete," and are made of "Securex" blocks, to the number of 10,500. These are 17 x 17 cm. square x 10 cm. thick. In building the pavilion, 100 metric tons of pressed glass were set into concrete. The floor is calculated to sustain a load of 500 kilos per square meter, as stipulated by the exposition authorities.

Of particular interest to the art student are four lovely windows; two by Lardeur, representing the blowing and drawing of glass, and two others by Gruber, delineating the ancient art of casting plate glass and the modern art of lamination. These windows are from the St. Just works, an affiliate of the Saint-Gobain Company.

Many types, shapes and colors of glass were used in the furnishings, floors and appointments. One of the pavements, in particular, is called upon to serve as a heating floor, and "Tepidor" glass blocks are used, plated on their under surface with a layer of aluminum. Of educational value and also serving to satisfy a curiosity-loving public, are many devices contrived to test and demonstrate the resistance and flexibility of tempered plate glass.

GLASS NEWS FROM ABROAD

Argentina—It is understood that a new glass manufacturing company, to be known as Vidrias Argentinas, S.A., is in the course of organization with a registered capital of 9,000,000 pesos, of which 3,000,000 will be subscribed in the near future. Report has it that the British glass manufacturers, Pilkington Bros. and Chance Bros., as well as the French St. Gobain company, are providing the capital. Located at Llavallol, the new plant should be ready to open in July with 250 employees. The company will concentrate on the manufacture of cathedral, rolled plate and wired types of glass. It is said that in addition Pilkington Bros. are building a new plant in close proximity for the manufacture of safety glass.

Austria—The hollow glass industry has been badly hit by the loss of the Italian market and stocks have become unmanageable. The improvement last year had persuaded firms to work during the off-season, which has accentuated the present over-supply. On top of this the French Government has just raised the import tariff.

Belgium—The general situation in the glass industry has improved considerably during the past two months, according to directors of the Verreries Bennert-Bivort et Courcelles Reunies. World demands have increased, and in this demand America plays a large part. In most of the glass-producing countries, there is said to have been an increase in consumption, with the result that competition from large producers has not been feared so much. Naturally, price movements have been affected by the increased demand.

Czechoslovakia—Czech glass exports last year were worth 787 million crowns (about 26 million dollars), an increase of 29 per cent over the preceding year. The plate and pressed glass sections contributed most to this increase, and they continue to be busy. Exporters are disappointed over the new French quotas and the poor Italian market, but business in other quarters is satisfactory. Moreover, various trade treaties now being negotiated should greatly improve export facilities to Italy and the United States in particular.

The fundamentally sound nature of the Czech industry is shown by the formation of a new firm, Mirolyt A. G., to take up all branches of glass manufacture. Three Belgian firms, St. Roch, Glaver and St. Gobain, are financially interested in the new concern. The glass industry has been completely rationalized during the past three or four years and all firms of importance use modern machine methods.

Egypt—It is reported that an American company has shown interest in the contemplated establishment of the first Egyptian plant for the manufacture of window glass, printed and frosted glass. However, studies are being made as to whether the Fourcault process or an American one will be adopted; at present there appears to be some reluctance as far as adopting the latter is concerned because of Egypt's limited market requirements, the current consumption of window glass being only 1,200,000 square meters from 1.5 to 5 millimeters thickness and that of printed glass totalling only about 120,000 square meters. Sand, calcareous materials and other raw materials are reported to be abundant in the Cairo district although the fuel will probably have to be coal imported from New Castle, England.

Germany—The 21st Congress of Glass Technicians was held at Berlin the end of February. The proceedings were opened by Major-General Loeb, representing the Government, and in his speech he emphasized the importance of glass as a material in the new Germany. It is one of the few things Germany can produce almost entirely from her own resources; already she is the world's third producer, with an output of 800,000 tons last year, but it should be the province of the technician to double that output by devising cheaper methods of manufacture and new uses for this adaptable material.

Leaving this political skirmishing on one side there is the fact that a new lacquer for backing mirrors has been produced. It is a rubberized substance, which affords complete protection against dampness, and as it can be treated with an adhesive mixture, mirrors can be placed straight into position against a wall without any wooden backing. A similar device of Italian origin is also in use; thin cork strips are glued to the back of the lacquer and may be glued straight on to a wall in the manner of plywood.

The contribution which rationalization has made towards the present prosperous position of the glass industry is illustrated by the accounts of the Rhenish Mirror Glassworks. Their new automatic plant began production in the middle of 1936 and the firm increased their dividend from four to six per cent this year. Sales increased, but only slightly, while such costs as wages and taxes have risen sharply; in other words the higher profits are due almost entirely to the greater efficiency of the new plant.

Italy—The turnover of the glass industry last year was 500 million lire, a considerable improvement over the 300 million at the depth of the depression in 1934. The number of firms at work has increased by 15 per cent and in spite of considerable mechanization the number of men employed is greater. The export trade has improved and thanks to import restrictions the country has developed a glass export surplus of 5,714,000 lire. The industry has great hopes of the mica deposits already discovered in Italian East Africa and a new company has already been formed to exploit them.

Japan—Due to the outbreak of the "China Incident," Japan's eports of glass ware to China have dropped drastically in recent months. During May, 1937, Japan's exports of glass ware to China totaled 104,904 yen, and in June as much as 125,525 yen. The exports dropped to 97,527 dozens, worth 46,696 yen, in July when the hostilities broke out. The following months saw a further decline. In contrast to the waning exports to the Chinese market, however, shipments to other major markets, such as South America, Near East, etc., have continued favorable, saving the total exports of glass ware from any noticeable recession as a whole. The blow is believed to be felt most acutely by small-scale and medium-size makers specializing in items destined for the Chinese market.

MECHANICAL DEVELOPMENTS OF THE LAST DECADE IN THE GLASS INDUSTRY

SPRECHSAAL, the famous German weekly that covers glass, enamel and ceramics, celebrated the completion of 70 years of publication with a special edition on Jan. 6, 1938. One of the leading articles was contributed by Dipl.-Ing. J. Thierry of the German Patent Office.

This writer reviews the inventions patented in Germany since 1927, pointing out that a great many of them have been of foreign origin, and urging a more alert attitude on the part of German inventors. He observes that most of the inventions relating to glasshouse machinery and construction during the past decade have been improvements and developments, and not fundamentally new practices or procedures.

Considering first the furnaces themselves, he mentions the continued competition between tanks with bridge walls, with floaters and with neither, each of which seems preferred for specific purposes. Certain inventions have attempted to reduce the rate of destruction of the blocks, in part by the use of more resistant materials, and in part by changes in construction. One of the ingenious methods proposed for the latter purpose is shown in Fig. 1. A floating, refractory body of circular cross-section rests against the sidewall blocks at the glass line. As corrosion occurs, it becomes unbalanced and rolls, presenting a fresh surface for attack and protecting the block itself from the deep grooving usually found at the metal line.

Several patents describe methods of forming the batch into briquettes and of preheating these briquettes with the waste gases before charging, in order to add to the melting efficiency. The remark is made that this process has great promise theoretically, although thus far it lacks practical demonstration.

In Fig. 2 is shown a patented style of tank, in which the charge is fed into a relatively shallow melting chamber, where it may be more effectively exposed to the action of the fire and delivered to the deeper refining and working chamber in practically plain condition.

Attempts have been made to overcome the bad effects of the currents in melting tanks, particularly the current returning from the working chamber through the throat by designs such as those shown in Fig. 3 and Fig. 4. In Fig. 3, the fire is obviously concentrated nearer the bridgewall, so as to set up a current at the surface toward the charging end. In Fig. 4, the tank bottom is sloped, with the idea of retarding not only the current of cold glass tending to come back from the working chamber, but also the accumulation of heavy contaminated glass resulting from the entrance of impurities from the blocks and from "tramp" material.

Gob feeders are given a good deal of attention. with special reference to some of the better-known American developments already familiar to readers of THE GLASS INDUSTRY. Regarding the revolving tank for suction-fed machines, Dr. Thierry thinks that its day is about over, because of the cost of its operation. As substitutes, a number of inventions provide for moving parts to agitate the glass in the forehearth so as to deliver fresh portions to the suction feed.

Batch feeders were the subject of interesting German patents. Fig. 5 shows one of these, planned to avoid the carriage of dust by the flame and to promote rapid and regular melting of the batch. The batch is fed into a relatively low chamber, where it remains until surface melting takes place, before it is pushed into the combustion chamber itself. Another invention provides for in-

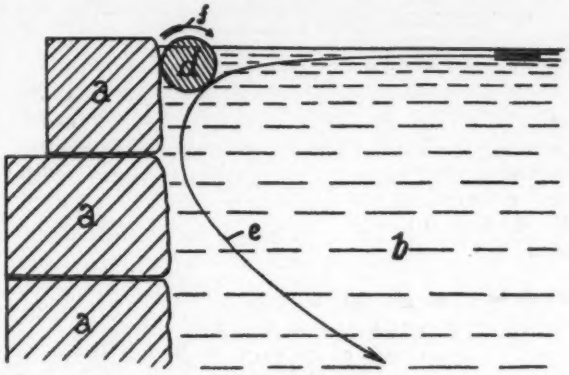


Fig. 1. Floating shield for metal-line blocks.

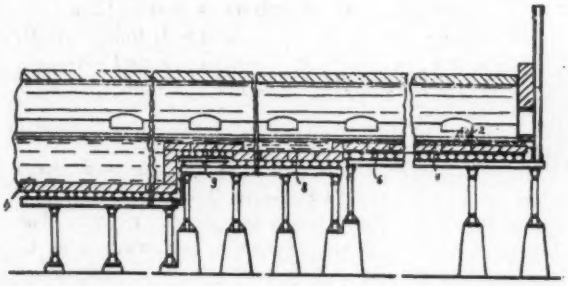


Fig. 2. Tank with shallow melting chamber.

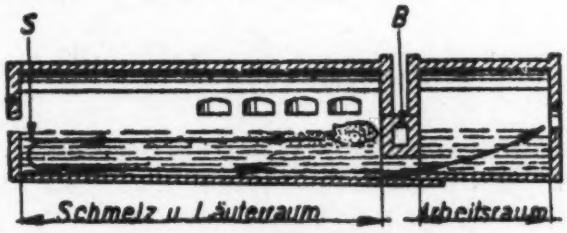


Fig. 3. Tank with ports grouped near bridge wall.

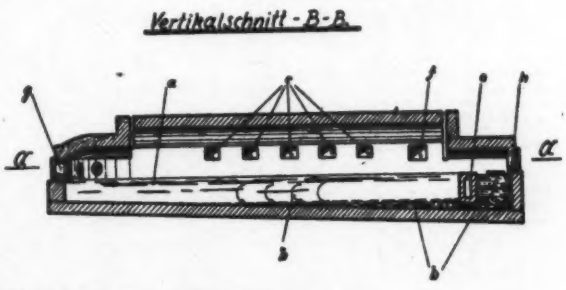


Fig. 4. Tank with sloping bottom.

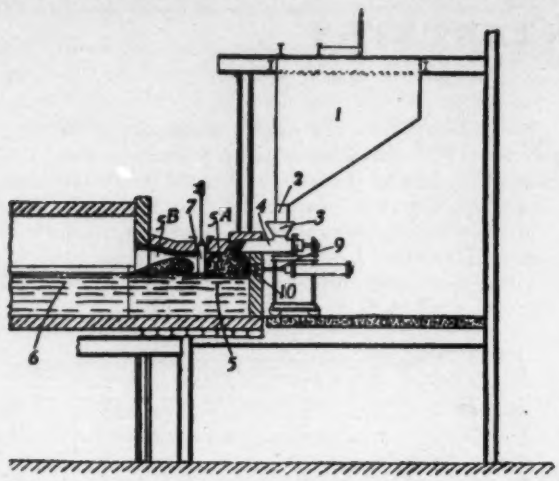


Fig. 5. Low-crowned doghouse and batch feeder.

troducing the batch in small masses, continuously spreading it across the entire breadth of the tank, where it melts in a band of slowly decreasing thickness and width. This prevents the sudden introduction of large quantities of charge at one time, which would cause a drop in temperature. While these procedures are also not completely demonstrated in practice, they are regarded as of great promise.

In remarks about the ribbon bulb machine ("Corning 399"), Dr. Thierry used the word "fantastic" in connection with its promise of production and seemed a trifle incredulous. It is apparent that information regarding the actual performance of these machines is not general in Germany.

Improvements in the Bicheroux Process for rolling plate glass, and also the Continuous-pour Process as developed by Ford, come in for lengthy mention.

Extended comment is made on the difficulties attending rolling plate glass in a continuous strip directly from the tank. Temperature control is regarded as the outstanding difficulty. In Fig. 6, a special type of forehearth is shown, which offers a variety of means for taking care of the temperature of the glass and the rate at which it flows to the rollers, providing for horizontal as well as vertical control of the temperatures.

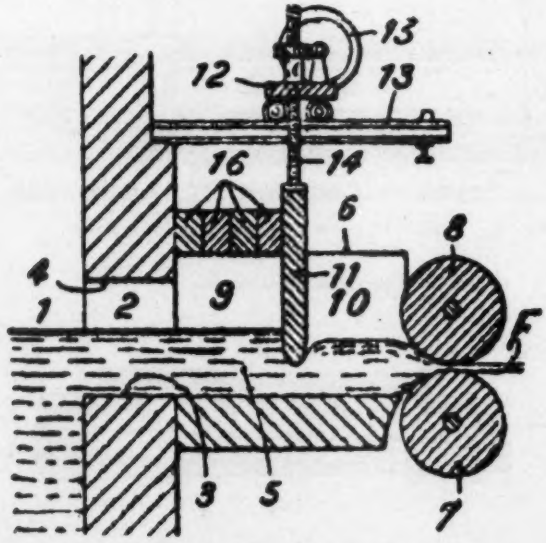


Fig. 6. Forehearth for rolling plate glass.

In connection with sheet glass drawn by the Fourcault process, interesting methods are described for putting a colored layer upon the surface of the sheet. This is to be done, according to Engels, by feeding the colored glass upon the "onion." Another invention sought a similar result by flowing colored glass upon the surface of the melt in the tank itself. Knoblauch proposes to feed the casing glass from the side into the debiteuse. There is no certainty that any of these processes have come into production.

Several other improvements and proposals are mentioned dealing with the production of glass tubing by the process of vertical drawing, and with the annealing and tempering of glass.

CERAMIC EDUCATION

Ceramic Engineering as a Career—"Ceramic Engineering as a Career" is the title of a monograph based on a study recently completed by The Institute for Research, 537 South Dearborn St., Chicago. Written primarily to inform the young man who plans a career in some branch of the ceramic industry, this 24-page brochure outlines in non-technical language the history of the industry, recent technical developments, training requirements, attributes and opportunities of the ceramic engineer. The book will be read with interest and profit by all persons engaged in the manufacture of ceramic materials and products.

Modern ceramics have been hampered by rule-of-thumb methods, trade secrets, and superstitions and prejudices, and it is only quite recently that modern research has been applied to the questions of suspensions, plastic working conditions, and silicate reactions. An adequate theory of the properties and structures of ceramic plastic materials has been obtained only after modern physical chemistry developed and generalized the specific field of colloid chemistry. Industrial progress in the ceramic industry under the influence of new technical advances by trained ceramic engineers has been rapid.

In the field of technical training, this monograph lists the schools where training in ceramic engineering is available, presents necessary personal qualifications, outlines typical entrance requirements (Ohio State) and a typical curriculum (N. Y. State College of Ceramics). This is followed by an interesting discussion of the types of positions available to the graduate ceramic engineer, the kind of work done, the characteristic of a well-trained ceramist and the opportunities and salaries available in the industry. The book is illustrated and carries a list of professional associations, scientific publications, trade associations, trade publications, and a bibliography of suggested readings, all associated with the ceramic industry.

FEBRUARY PLATE GLASS PRODUCTION

The total production of polished plate glass by member companies of the Plate Glass Manufacturers of America in February 1938 was 2,663,835 sq. ft., as compared to 5,119,182 sq. ft. produced by the same companies in January and 18,676,371 sq. ft. produced in the corresponding month last year, February 1937.

METHOD OF DETERMINING DENSITY OF MOLTEN GLASS

By A. E. BADGER and C. G. HARMAN*

The measurement of the density of molten glasses has been carried out by several investigators, including Li[1] (1922), and more recently by Hänlein[2] (1932), Endell and Wens[3] (1935), and Heidtkamp and Endell[4] (1936). The basis of these methods is Archimedes' Principle concerning the buoyant force of fluids.

Another principle may be utilized to determine the density of molten glass by measuring the pressure in a bubble which is blown at the tip of a capillary tube immersed at a known depth beneath the surface of the glass[5].

In order to test the method, a common bottle glass was chosen, having the percentage composition:

74.15 SiO_2	0.55 BaO
1.20 R_2O_3	0.11 MgO
8.47 CaO	15.52 Alkalies

The glass was placed in a refractory crucible which was wound with a platinum wire heating element (see illustration). A thermocouple was placed in the glass and the temperature raised to 1300°C where it was maintained for 12 hours.

A platinum tube of 1 mm. bore was then lowered beneath the glass surface and the pressure necessary to form a bubble at the tip was measured. The tube was then lowered 2.345 cm. (obtained from readings on a dial gauge) and another pressure reading obtained. From these pressure readings and other pertinent data, the density of glass at 1300°C was computed to be 2.36 grams per cubic centimeter, as shown in the following:

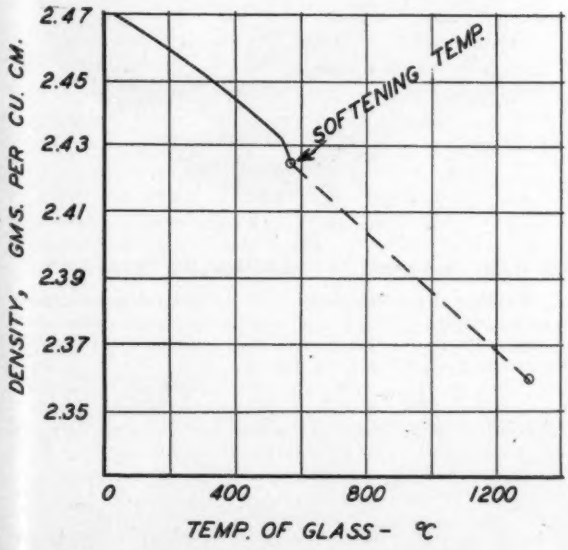
Distance platinum tip lowered	2.345 cm.
Increase in pressure on liquid gauge necessary to force bubble from tip	5.44 cm.
Density of gauge liquid	1.0397 gm./cu. cm.
Volume of glass displaced by immersion of platinum tube	0.31 cu. cm.
Rise of glass level in crucible due to immersion of platinum tube	0.053 cm.
Actual increase in depth of platinum tip	2.398 cm

$$\text{Density of glass at } 1300^\circ\text{C} = \frac{5.44 \times 1.0397}{2.398} = 2.36 \text{ gm./cu. cm.}$$

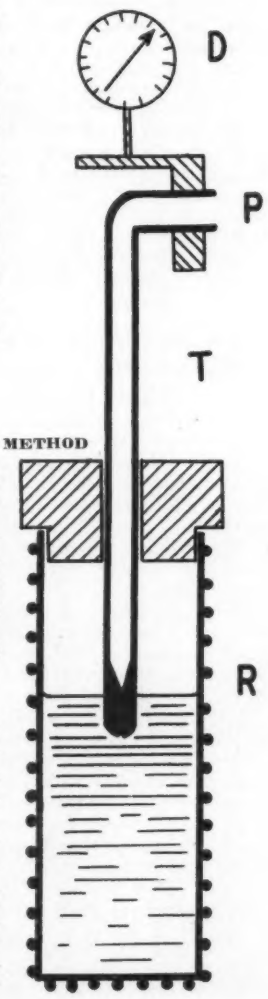
The value of density so determined is plotted in the accompanying density-temperature graph. The density at room temperature was found to be 2.47 by the method of hydrostatic weighing. From the thermal expansion curve of the glass, as determined by the interferometer method, the change in density with temperature was computed up to the softening temperature of the glass. These results are shown by the heavy line in the graph, which is a smooth curve except for the characteristic break near the softening temperature.

The density of the glass in the region which extends from the softening temperature to 1300°C was not determined and is represented by the dotted line in the graph. These measurements were not attempted since the method which has been described is not adapted to conditions in which the glass has somewhat high viscosity.

Although no exact comparison with the results of other investigations can be made with the above data, the results of Li[1] and of Hänlein[2] are of interest. The former's data indicate a density of 2.30 at 1300°C for the glass 73.5% SiO_2, 16.5% Na_2O, 10.0% CaO, while Hänlein obtained a density of 2.27 at 1300°C for the glass 71.0% SiO_2, 0.5% Al_2O_3, 16.5% Na_2O, 1.0% K_2O, 3.5% MgO, 5.5% CaO, 2.0% BaO.



Variation of Density of Glass with Temperature.



ILLUSTRATING PRINCIPLE OF METHOD

D, dial gauge used to measure depth of immersion of tip; P, connection to air pressure and pressure gauge system; T, platinum tube (outside diameter, 4 mm; bore of tip, 1 mm); R, refractory crucible (height, 8 cm; bore, 2.7 cm) containing glass. Wound with platinum resistor wire. Insulation of crucible not shown.

[1] S. H. Li, Bachelor's Thesis, Univ. of Illinois. 1922. Results published in Bulletin 140, Eng. Exp. Sta., Univ. of Illinois (1924), by E. W. Washburn, G. R. Shelton, and E. E. Libman.

[2] W. Hänlein, Glastech. Ber. 10, 126 (1932).

[3] K. Endell and C. Wens, ibid. 13, 78 (1935).

[4] G. Heidtkamp and K. Endell, ibid. 14, 89 (1936).

[5] It was learned later that a similar method was used for liquids at room temperature by A. Ferguson and J. A. Hakes: Proc. Phys. Soc., Lond. 41, 214 (1928-9).

*Department of Ceramic Engineering, Engineering Experiment Station, University of Illinois.

EQUIPMENT AND SUPPLIES

UNIVERSAL CARRIER CHAIN

A new type of conveyor chain recently announced by the Link-Belt Company, 301 N. Michigan Ave., Chicago, Ill., is designated Universal Carrier Chain on account of its special characteristics. As shown in the accompanying illustration, the new product is capable of operating in two planes and is suited for handling bottles, jars and other types of containers in the process of manufacture.

The two-plane travel feature makes it practical to use this chain in rectangular, circular, semi-circular or irregular paths and to use but one long conveyor, if desired, instead of several transfer conveyors with individual driving mechanisms. The construction of the chain provides a continuous, unbroken carrying surface of uniform width whether the chain is moving in a straight line or turning around a sprocket wheel.

NEW FEATURES IN BROWN RECORDING PYROMETER

Brown Instrument Co., Philadelphia, is now furnishing a multi-color, numeral-printing potentiometer pyrometer which not only records several temperatures on one chart, but also provides a more legible record in both multi-color and numerals. When the temperature changes overlap, no special skill is required to decipher every detail of the chart record.

Only one symbol, the plus sign, is used and a numeral printed beside the symbol identifies the thermo-couple from which the temperature record is made. The vertical line of the plus sign indicates the temperature and the horizontal line shows the time coordinate. The intersection of the two lines locates the exact point of the time-temperature record. By means of a 12-inch chart and this method of printing it is possible to record from two to six temperatures continuously.

NEW KILNS FOR FINDLAY

To further improve its glass tank refractory blocks, the Findlay Clay Products Co., Pittsburgh, has recently installed new gas-fired kilns to replace coal-fired kilns. Findlay reports that this type of glass tank refractory block has a remarkably long life. The gas kiln installation was made with the cooperation of the Industrial Gas Dept. of the Manufacturers Light & Heat Co., Pittsburgh.

CATALOGS RECEIVED

Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill. Bulletin 2260 gives construction details of direct-current motors in sizes up to 200 h.p., with a variety of mechanical modifications for both high and low voltage operation.

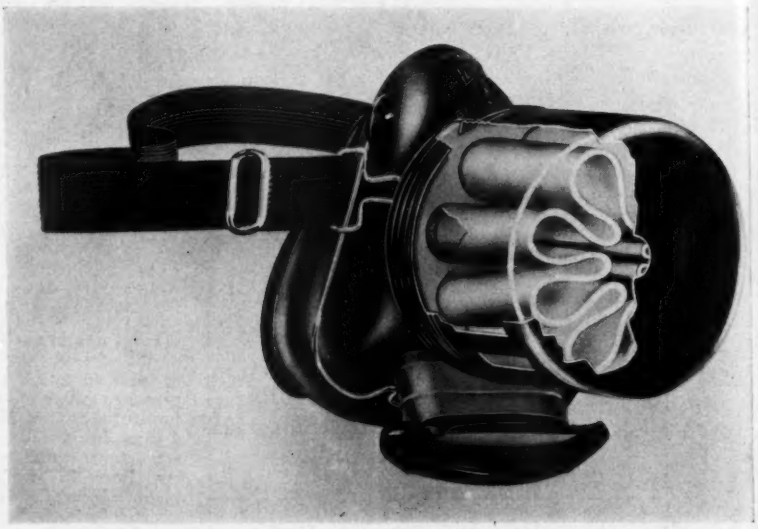
Robert Gair Co., Inc., 155 East 45th St., New York. "Sealing of Corrugated and Solid Fibre Containers," by J. D. Malcolmson, is more or less of a text book on this important subject. It covers adhesives, gummed paper tape, metal stitches and staples, and metal strips or wire.

Stephens-Adamson Mfg. Co., Aurora, Ill. Catalog No. 68 shows the operation of J. F. S. variable speed reducers, which combine the functions of speed-changer and speed-reducer. Four types are described, including new motorized and differential units.

George Gorton Machine Co., Racine, Wis., has just issued a new catalog, 1400-A, describing high precision machines designed particularly for die, mold and fine tool room work. These machines attain speeds of 6,300 r.p.m. with standard equipment and 12,000 r.p.m. with special equipment. These high speeds are said to enable running at maximum efficiency cutters of from a few thousandths to 1¼ in. diameter.

NEW FLUX BLOCK

Announcement has been made by Walsh Refractories Corporation, St. Louis, Mo., that after approximately one year of testing under actual operating conditions, it is now ready to actively market its new vacuum cast flux block. This new Walsh product has been trade-marked Walsh Cast-Flux and is manufactured under a license held by the corporation. It is reported to have a dense uniform structure, thoroughly bonded with a low coefficient of expansion. All blocks are machine trued to exact size and shape after burning.

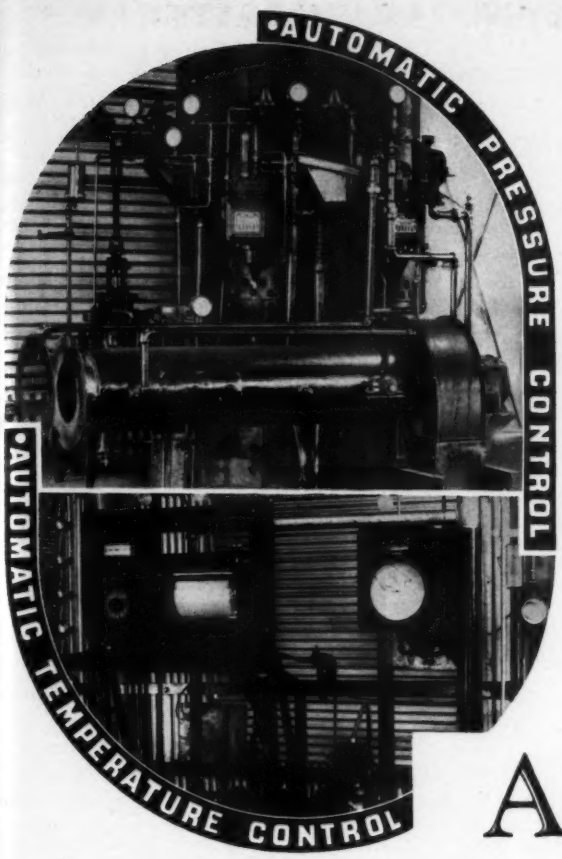


NEW ROTIFORM RESPIRATOR DEVELOPED BY WILLSON

Willson Products, Inc., Reading, Pa., advises that the United States Bureau of Mines has approved their new Rotiform Respirator for protection against Type "A" dusts such as silica quartz, asbestos, aluminum, iron ores, etc., produced in the process of grinding, mining and quarrying; and in the industrial operations of grinding, crushing.

The felt filter is so designed that an effective filtering surface of more than 30 sq. in. is confined in a relatively small area, providing adequate filtering efficiency with low breathing resistance. The only wear on the construction takes place when it is removed from the respirator for cleaning. When clogged with collected dust to the point that breathing resistance is increased, it may easily be cleaned by introducing a jet of compressed air into the core.

A metal cover protects the filter from contact with the wearer's hands, keeping it clean to surface dirt, grease, oil, etc. Spectacles or safety goggles can be worn readily with the respirator.



No more Guesswork

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AUTOMATIC CONTROL

AT LAST, guesswork in furnace operation has been removed by AMCO. Now, it is possible to obtain consistent and unvarying operating conditions continuously and automatically.

The new AMCO automatically controlled tanks and furnaces do away with the human element in glass-melting and thus increase and improve production with greater uniformity and less cost!

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The AMSLER-MORTON COMPANY
FULTON BUILDING • PITTSBURGH, PA.

CURRENT PRICES OF GLASS-MAKING MATERIALS

FURNISHED BY PRODUCERS, MANUFACTURERS AND DEALERS

Base Materials

		Carlots	Less Carlots
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	43.00	46.00
Barium sulphate, in bags	ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk f. o. b. shipping point	ton	15.00-16.00	18.00
Borax ($Na_2B_4O_710H_2O$)	lb.	....	....
Granulated	In bags, lb.	.021	.0255-.028
Powdered	In bags, lb.	.0235	.028-.0305
Boric acid (H_3BO_3) granulated	In bags, lb.	.0475	.0525-.055
Calcium phosphate ($Ca_3(PO_4)_2$)	lb.	.07	.07½
Cryolite ($Na_3Al\ F_6$) Natural Greenland (Kryolith)	lb.	.0875	.0925
Synthetic (Artificial)	lb.	.0875	.0925
Feldspar—			
20 mesh	ton	11.00-13.25	
40 mesh	ton	11.50-13.75	
Granular	ton	11.75-14.00	
Semi-granular	ton	11.00-13.25	
L. C. L., (Min. 2 tons) $3.00 per ton additional plus charge for bags			
Fluorspar (CaF_2) domestic, ground, 96-98% (max SiO_2, 2½%)			
Bulk, carloads, f. o. b. mines	ton	31.50	....
In bags	ton	33.10	38.00-40.60
Kryolith (see Cryolite)			
Lead Oxide (Pb_3O_4) (red lead) (N. Y.)	lb.	.07	....
In 5 Ton lots	lb.	....	.075
Less than 5 Tons	lb.	....	.08
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	10.50	....
Burnt (CaO) ground, in bulk	ton	7.00	....
Burnt, ground, in paper sacks	ton	9.00	....
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.25	2.25
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.065	.0675
Hydrated 80-85%	lb.	.055	.0575
Salt cake, glassmakers (Na_2SO_4)	ton	16.00	27.00
Soda ash (Na_2CO_3) dense, 58%—			
Bulk	Flat Per 100 lb.	.95	....
In barrels	Per 100 lb.	1.35	....
In bags	Per 100 lb.	1.10	....
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	Per 100 lb.	....	2.50-2.90
95% and 97%			
Bulk	Per 100 lb.	1.35	....
200 lb. bags		1.415	1.44
100 lb. bags		1.45	1.475

Special Materials

		Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)	lb.	....	.03½
Aluminum oxide (Al_2O_3)	lb.	.04	.05
Antimony oxide (Sb_2O_3)	lb.	.12½	.13
Arsenic trioxide (As_2O_3) (dense white) 99%	lb.	.03	.03½
Barium nitrate ($Ba(NO_3)_2$)	lb.	....	.07¾
Rutile (TiO_2) powdered, 95%	lb.	.11-.12	.13-.15
Sodium fluosilicate (Na_2SiF_6)	lb.	.05½-.05¾	.06½
Tin Oxide (SnO_2) in bbls.	lb.	....	.47
Zinc Oxide (ZnO)			
American process, Bags	lb.	.06¼	.06½
White Seal, 150 lb. bbls.	lb.	.08¼	.09
Green Seal bags	lb.	.08	.08¼
Domestic White Seal bags	lb.	.08½	.08¾
Red Seal, bags	lb.	.07½	.07¾
Zircon			
Refined Granular (Milled .005-.02c higher)		.07	0.7½-.08
Commercial, Gran. (Milled .005-.02c higher)		.03	.04-.05

Coloring Materials

		Carlots	Less Carlots
Barium selenite ($BaSeO_3$)	lb.	....	1.50-1.75
(Commercial, 25% Selenium)	lb.	....	.90
Cadmium sulphide (CdS)	lb.	....	1.25-1.35
Chromite (99% through 200 mesh)	lb.	37.00	40.00
Cerium hydrate			
100 lb. drums and 600 lb. barrels	lb.	....	.60
Chrome Oxide Green. 400 lb. bbls.	lb.	....	.22-.26
Cobalt oxide (Co_2O_3)			
In bbls. 350 lbs. or more,	lb.	....	1.67
Less than 350 lbs.,	lb.	....	1.77
Copper oxide			
Red (Cu_2O)	lb.	....	.20¼
Black (CuO)	lb.	....	.15-.17½
Black prepared	lb.	....	.22
Iron Oxide—			
Red (Fe_2O_3)	lb.	....	.0425
Black (Fe_3O_4)	lb.	.04½	....
Iron Chromate	lb.	....	.035-.05
Lead Chromate ($PbCrO_4$)	lb.	....	.16
Manganese, Black Oxide			
In Paper bags	ton	57.00	64.50-66.50
In Burlap bags	ton	65.50	67.50-69.50
In Casks	ton	70.50	72.50-74.50
Neodymium oxalate, 50 lb. drums	lb.	....	3.50
Nickel oxide (Ni_2O_3), black	lb.	....	.35-.40
Nickel monoxide (NiO), green	lb.	....	.35-.40
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08¾	.0925
Powdered	lb.	....	.0975
Potassium Chromate (K_2CrO_4) 100 lb. kegs	lb.	....	.27
Powder blue	lb.	....	.2075-.2125
Pyrophyllite, Standard Grade	lb.	9.00	12.00
Rare earth hydrate			
100 lb. drums	lb.	....	.35
325 lb. barrels	lb.	....	.30
Selenium (Se) In 100 lb. lots	lb.	....	2.00
In lesser quantities	lb.	....	2.10
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06¾	.0725
Sodium chromate (Na_2CrO_4) Anhydrous	lb.	.08¼	.08½
Sodium selenite (Na_2SeO_3)	lb.	....	1.80-2.00
Sodium uranate (Na_2UO_4) Orange	lb.	....	1.50-1.55
Yellow	lb.	....	1.50-1.55
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.35	3.70-4.10
Flowers, in bags	Per 100 lb.	3.00	3.35-3.75
Flour, heavy, in 250 lb. bbls.	Per 100 lb.	2.90	3.25-3.65
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black	lb.	....	2.25
Yellow orange	lb.	....	1.50

Polishing Materials

		Carlots	Less Carlots
Emery, Turkish	lb.	....	.07
Pumice Stone,			
American Ground Italian FFF, FF, F	lb.	....	.03
0, 0½, ¾, 1.	lb.	....	.03¼
Putty Powder	lb.	....	.38-.42
Rotten Stone	lb.	....	.03
Rouge, Red	lb.	....	.14
Black	lb.	....	.16

GAS AND GLASS DISCUSSED

Some excellent papers of interest to glass men and ceramists were given at the American Gas Association conference on industrial gas sales, held in Pittsburgh, March 7 and 8. Much active discussion followed these informative papers.

The first speaker, the afternoon of March 7, was Harvey C. Weller, Surface Combustion Corporation, whose subject was "A Discussion of Gas in the Glass Industry." He told how forced convection heating, which has been so successful in modern industrial furnace applications in other fields within the temperature ranges of 600 to 1200 degrees F., has been applied to gas lehrs with very happy results, most important of which was the elimination of the muffle. Mr. Weller then descussed the direct firing of ceramic colors on glass. He said, "An oxidizing atmosphere is necessary and when manufactured gas with considerable sulphur is used, gas radiant tubes are employed."

Philip Dressler, Swindell-Dressler Corporation, described the interesting gas decorating kiln recently installed at the Lenox potteries in Trenton, N. J., which are heated with gas radiant tubes. Ralph L. Manier, Central New York Power Corporation, told about bisque and glost kilns in Syracuse that had successfully been converted from electricity to gas radiant tube heating. C. B. Mershon stated that a circular type kiln, 50 feet in diameter. at the Shenango Pottery was heated by this method. This kiln has a capacity of 1,000 dozen pieces of china per day. Mr. Dressler thought that the gas radiant tube method of heating would eventually become standard for porcelain enamel furnaces.

PASK APPOINTED BY U. OF ILL.

The Department of Ceramic Engineering, University of Illinois, has announced the appointment of Joseph A. Pask to the staff as assistant. Following his graduation from Illinois, Mr. Pask received his M. S. in Ceramic Engineering from the University of Washington and then went to work for the Willamina Clay Products Co., and later with the U. S. Bureau of Mines as a petrographer. Mr. Pask returned to the University of Illinois in September, 1936.

RESEARCH FOR CERAMIC INDUSTRIES

The Batelle Memorial Institute, Columbus, has published a handsome brochure entitled "Research for Ceramic Industries," to show how this Institute can assist industry. The Institute, which was endowed to promote research in ceramics, metallurgy, fuels and chemistry, although financially independent, has adopted a policy of conducting research and development for industry at cost in order to increase its scope of work and usefulness.

- The Twentieth Annual Convention of the National Lime Association and the lime industry of the United States will be held at the Netherlands-Plaza Hotel in Cincinnati, May 9-11, inclusive.

- Frank L. Lloyd has been appointed Special Machine Sales Engineer for the Crown Cork and Seal Co., with whom he has held various positions for the past 24 years. Mr. Lloyd will devote much of his time to field work, keeping in active touch with the problems of bottlers and brewers.

A Second Edition of

- GLASS
- TANK
- FURNACES

is in course of preparation. So great was the demand for this outstanding work that the original edition was completely sold out by January first.

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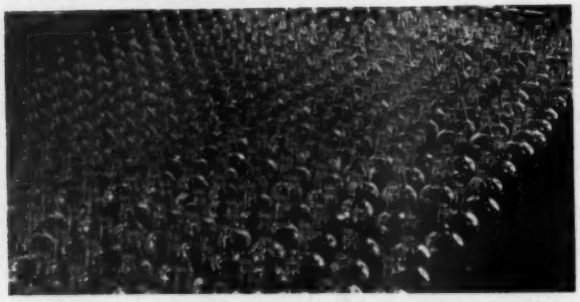

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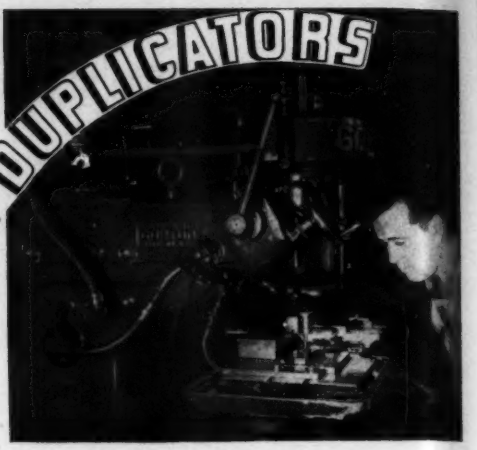

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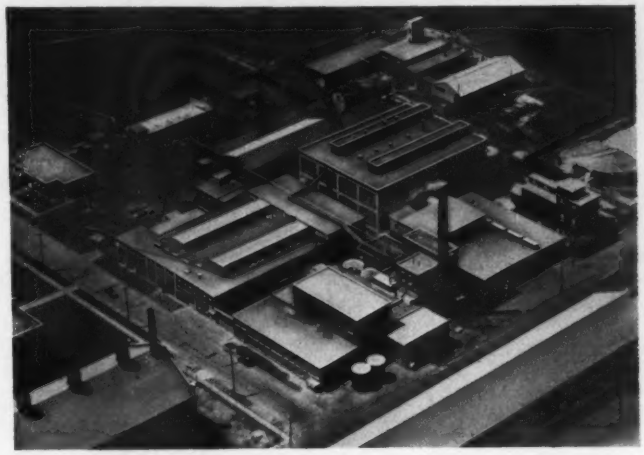

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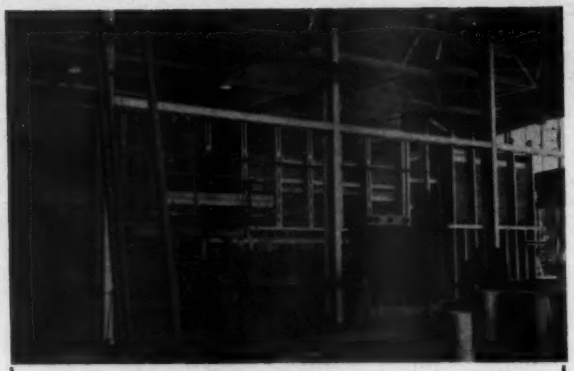

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